

conjunction with a genetic vaccine. The choice of vector and components can also be optimized for the particular purpose of treating allergy or other conditions. In one aspect, the optimized genetic vaccine components are used in conjunction with other optimized genetic vaccine reagents. For example, an antigen that is useful for a particular condition can be optimized by methods analogous to the reassembly (&/or one or more additional directed evolution methods described herein) and screening methods described herein.

The polynucleotide that encodes the recombinant antigenic polypeptide can be placed under the control of a promoter, e.g., a high activity or tissue- specific promoter. The promoter used to express the antigenic polypeptide can itself be optimized using reassembly (&/or one or more additional directed evolution methods described herein) and selection methods analogous to those described herein., as described in International Application No. PCT/US97/17300 (International Publication No. WO 98/13487).

The vector can contain immunostimulatory sequences such as are described herein. A vector engineered to direct a T_H1 response can be used for many of the immune responses mediated by the antigens described herein. The reagents obtained using the methods of the invention can also be used in conjunction with multicomponent genetic vaccines, which are capable of tailoring an immune response as is most appropriate to achieve a desired effect. It is sometimes advantageous to employ a genetic vaccine that is targeted for a particular target cell type (e.g., an antigen presenting cell or an antigen processing cell); suitable targeting methods are described herein.

Delivery of genetic vaccines and delivery vehicles to mammals *in vivo* and *ex vivo*

Genetic vaccines, (e.g. genetic vaccines that include the optimized experimentally generated polynucleotides obtained as described herein, such as genetic vaccines that encode the multivalent antigens described herein, including the multicomponent genetic vaccines described herein), can be delivered to a mammal (including humans) to induce a therapeutic or prophylactic immune response. Vaccine delivery vehicles can be delivered *in vivo* by administration to an individual patient, typically by systemic administration (e.g., intravenous, intraperitoneal, intramuscular, subdermal, intracranial, anal, vaginal, oral, buccal route or they can be inhaled) or they can be administered by topical application.

Alternatively, vectors can be delivered to cells *ex vivo*, such as cells explanted from an individual patient (e.g., lymphocytes, bone marrow aspirates, tissue biopsy) or universal

donor hematopoietic stem cells, followed by reimplantation of the cells into a patient, usually after selection for cells which have incorporated the vector.

Delivery methods and references

A large number of delivery methods are well known to those of skill in the art. Such methods include, for example liposome-based gene delivery (Debs and Zhu (1993) WO 93/24640; Mannino and Gould-Fogerite (1988) BioTechniques 6(7): 682- 691; Rose U.S. Pat No. 5,279,833; Brigham (1991) WO 91/06309; and Felgner et al. (1987) Proc. Natl. Acad. Sci. USA 84: 7413-7414), as well as use of viral vectors (e.g., adenoviral (see, e.g., Berns et al. (1995) Ann. NY Acad Sci. 772: 95-104; Ali et al. (1994) Gene Ther. 1: 367-3 84; and Haddada et al. (1995) Curr. Top. Microbiol. Immunol. 199 (Pt 3): 297- 306 for review), papillomaviral, retroviral (see, e.g., Buchscher et al. (1992) J Virol. 66(5) 2731-2739; Johann et al. (1992) J Virol. 66 (5):163 5-1640 (1992); Sommerfelt et al. , (1990) Virol. 176:58-59; Wilson et al. (1989) J Virol. 63:2374-2378; Miller et al., J Virol. 65:2220-2224 (1991); Wong-Staal et al., PCT/US94/05700, and Rosenberg and Fauci (1993) in Fundamental Immunology, Third Edition, Paul (ed) Raven Press, Ltd., New York and the references therein, and Yu et al., Gene Therapy (1994) supra.), and adeno-associated viral vectors (see, West et al. (1987) Virology 160:3 8-47; Carter et al. (1989) U. S. Patent No. 4,797,3 68; Carter et al. WO 93/24641 (1993); Kotin (1994) Human Gene Therapy 5:793 - 801; Muzyczka (1994) J Clin. Invest. 94:1351 and Samulski (supra) for an overview of AAV vectors; see also, Lebkowski, U.S. Pat. No. 5,173,414; Tratschin et al. (1985) Mol. Cell. Biol. 5(11):3251-3260; Tratschin, et al. (1984) Mol. Cell. Biol., 4:2072- 2081; Hermonat and Muzyczka (1984) Proc. Natl. Acad Sci. USA, 81:6466-6470; McLaughlin et al. (1988) and Samulski et al. (1989) J Virol., 63:03 822-3 828), and the like.

Introduction of "Naked" DNA and/or RNA that comprises a genetic vaccine directly into a tissue or using "biolistic" or particle-mediated transformation, both *in vivo* and *ex vivo*

"Naked" DNA and/or RNA that comprises a genetic vaccine can be introduced directly into a tissue, such as muscle. See, e.g., USPN 5,580, 859. Other methods such as "biolistic" or particle-mediated transformation (see, e.g., Sanford et al., USPN 4,945,050; USPN 5,036,006) are also suitable for introduction of genetic vaccines into cells of a mammal according to the invention. These methods are useful not only for *in vivo* introduction of DNA into a mammal, but also for *ex vivo* modification of cells for reintroduction into a mammal. As for other methods of delivering genetic vaccines, if

necessary, vaccine administration is repeated in order to maintain the desired level of immunomodulation.

SUMMARY OF TABLES 1-85

These tables show preferred, but non-limiting, examples of 3-base long mutagenic cassettes that are non-stochastic and degenerate.

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Table #	Triplet Sequence	Site 1	Site 2	Site 3
1.	N,N,G/T	N	N	G/T
2.	N,N,G/C	N	N	G/C
3.	N,N,G/A	N	N	G/A
4.	N,N,A/C	N	N	A/C
5.	N,N,A/T	N	N	A/T
6.	N,N,C/T	N	N	C/T
7.	N,N,N	N	N	N
8.	N,N,G	N	N	G
9.	N,N,A	N	N	A
10.	N,N,C	N	N	C
11.	N,N,T	N	N	T
12.	N,N,C/G/T	N	N	C/G/T
13.	N,N,A/G/T	N	N	A/G/T
14.	N,N,A/C/T	N	N	A/C/T
15.	N,N,A/C/G	N	N	A/C/G
16.	N,A,A	N	A	A
17.	N,A,C	N	A	C
18.	N,A,G	N	A	G
19.	N,A,T	N	A	T
20.	N,C,A	N	C	A
21.	N,C,C	N	C	C
22.	N,C,G	N	C	G
23.	N,C,T	N	C	T
24.	N,G,A	N	G	A
25.	N,G,C	N	G	C
26.	N,G,G	N	G	G
27.	N,G,T	N	G	T
28.	N,T,A	N	T	A
29.	N,T,C	N	T	C
30.	N,T,G	N	T	G
31.	N,T,T	N	T	T
32.	N,A/C,A	N	A/C	A
33.	N,A/G,A	N	A/G	A
34.	N,A/T,A	N	A/T	A
35.	N,C/G,A	N	C/G	A
36.	N,C/T,A	N	C/T	A
37.	N,T/G,A	N	T/G	A
38.	N,C/G/T,A	N	C/G/T	A
39.	N,A/G/T,A	N	A/G/T	A
40.	N,A/C/T,A	N	A/C/T	A
41.	N,A/C/G,A	N	A/C/G	A
42.	A,N,N	A	N	N

Table #	Triplet Sequence	Site 1	Site 2	Site 3
43.	C,N,N	C	N	N
44.	G,N,N	G	N	N
45.	T,N,N	T	N	N
46.	A/C,N,N	A/C	N	N
47.	A/G,N,N	A/G	N	N
48.	A/T,N,N	A/T	N	N
49.	C/G,N,N	C/G	N	N
50.	C/T,N,N	C/T	N	N
51.	G/T,N,N	G/T	N	N
52.	N,A,N	N	A	N
53.	N,C,N	N	C	N
54.	N,G,N	N	G	N
55.	N,T,N	N	T	N
56.	N,A/C,N	N	A/C	N
57.	N,A/G,N	N	A/G	N
58.	N,A/T,N	N	A/T	N
59.	N,C/G,N	N	C/G	N
60.	N,C/T,N	N	C/T	N
61.	N,G/T,N	N	G/T	N
62.	N,A/C/G,N	N	A/C/G	N
63.	N,A/C/T,N	N	A/C/T	N
64.	N,A/G/T,N	N	A/G/T	N
65.	N,C/G/T,N	N	C/G/T	N
66.	C,C,N	C	C	N
67.	G,G,N	G	G	N
68.	G,C,N	G	C	N
69.	G,T,N	G	T	N
70.	C,G,N	C	G	N
71.	C,T,N	C	T	N
72.	T,C,N	T	C	N
73.	A,C,N	A	C	N
74.	G,A,N	G	A	N
75.	A,T,N	A	T	N
76.	C,A,N	C	A	N
77.	T,T,N	T	T	N
78.	A,A,N	A	A	N
79.	T,A,N	T	A	N
80.	T,G,N	T	G	N
81.	A,G,N	A	G	N
82.	G/C,G,N	G/C	G	N
83.	G/C,C,N	G/C	C	N
84.	G/C,A,N	G/C	A	N
85.	G/C,T,N	G/C	T	N

TABLE 1. N, N, G/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	15
GGC	NO				
GGA	NO				
GGG	YES				
GCT	YES	ALANINE	2		
GCC	NO				
GCA	NO				
GCG	YES				
GTT	YES	VALINE	2		
GTC	NO				
GTA	NO				
GTG	YES				
TTA	NO	LEUCINE	3		
TTG	YES				
CTT	YES				
CTC	NO				
CTA	NO				
CTG	YES				
ATT	YES	ISOLEUCINE	1		
ATC	NO				
ATA	NO				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	2		
CCC	NO				
CCA	NO				
CCG	YES				
TCT	YES	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	NO				
TCA	NO				
TCG	YES				
AGT	YES				
AGC	NO				
TGT	YES	CYSTEINE	1		
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	NO	GLUTAMINE	1		
CAG	YES				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	2		
ACC	NO				
ACA	NO				
ACG	YES				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	NO				
GAA	NO	GLUTAMIC ACID	1		
GAG	YES				
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	YES				
CGT	YES	ARGININE	3		
CGC	NO				
CGA	NO				
CGG	YES				
AGA	NO				
AGG	YES				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	NO	STOP CODON	1	STOP SIGNAL (STP)	1
TAG	YES				
TGA	NO				
64	32	20 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 15: 9: 2: 5: 1	

TABLE 2. N, N, G/C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	2	NONPOLAR (NPL)	15
GGC	YES				
GGA	NO				
GGG	YES				
GCT	NO	ALANINE	2		
GCC	YES				
GCA	NO				
GCG	YES				
GTT	NO	VALINE	2		
GTC	YES				
GTA	NO				
GTG	YES				
TTA	NO	LEUCINE	3		
TTG	YES				
CTT	NO				
CTC	YES				
CTA	NO				
CTG	YES				
ATT	NO	ISOLEUCINE	1		
ATC	YES				
ATA	NO				
ATG	YES	METHIONINE	1		
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	NO	PROLINE	2		
CCC	YES				
CCA	NO				
CCG	YES				
TCT	NO	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	YES				
TCA	NO				
TCG	YES				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	NO	GLUTAMINE	1		
CAG	YES				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	2		
ACC	YES				
ACA	NO				
ACG	YES				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	YES				
GAA	NO	GLUTAMIC ACID	1		
GAG	YES				
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	YES				
CGT	NO	ARGININE	3		
CGC	YES				
CGA	NO				
CGG	YES				
AGA	NO				
AGG	YES				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	NO	STOP CODON	1		
TAG	YES				
TGA	NO				
64	32	20 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 15: 9: 2: 5: 1	

TABLE 3. N, N, G/A

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	NO		GLYCINE	2	NONPOLAR (NPL)	15		
GGC	NO							
GGA	YES							
GGG	YES							
GCT	NO		ALANINE	2				
GCC	NO							
GCA	YES							
GCG	YES							
GTT	NO		VALINE	2				
GTC	NO							
GTA	YES							
GTG	YES							
TTA	YES		LEUCINE	4				
TTG	YES							
CTT	NO							
CTC	NO							
CTA	YES							
CTG	YES							
ATT	NO		ISOLEUCINE	1				
ATC	NO							
ATA	YES							
ATG	YES		METHIONINE	1				
TFT	NO		PHENYLALANINE	0				
TTC	NO							
TGG	YES		TRYPTOPHAN	1				
CCT	NO		PROLINE	2				
CCC	NO							
CCA	YES							
CCG	YES							
TCT	NO		SERINE	2	POLAR NONIONIZABLE (POL)	6		
TCC	NO							
TCA	YES							
TCG	YES							
AGT	NO		CYSTEINE	0				
AGC	NO							
TGT	NO							
TGC	NO							
AAT	NO		ASPARAGINE	0				
AAC	NO							
CAA	YES		GLUTAMINE	2				
CAG	YES							
TAT	NO		TYROSINE	0				
TAC	NO		THREONINE	2				
ACT	NO							
ACC	NO							
ACA	YES							
ACG	YES							
GAT	NO		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2		
GAC	NO		GLUTAMIC ACID	2				
GAA	YES							
GAG	YES							
AAA	YES		LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6		
AAG	YES							
CGT	NO		ARGININE	4				
CGC	NO							
CGA	YES							
CGG	YES							
AGA	YES							
AGG	YES							
CAT	NO		HISTIDINE	0				
CAC	NO							
TAA	YES		STOP CODON	3	STOP SIGNAL (STP)	3		
TAG	YES							
TGA	YES							
64	32	14 Amino Acids Are Represented			NPL:POL:NEG:POS:STP = 15: 6: 2: 6: 3			

TABLE 4. N, N, A/C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	2	NONPOLAR (NPL)	14
GGC	YES				
GGA	YES				
GGG	NO				
GCT	NO	ALANINE	2		
GCC	YES				
GCA	YES				
GCG	NO				
GTT	NO	VALINE	2		
GTC	YES				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	3		
TTG	NO				
CTT	NO				
CTC	YES				
CTA	YES				
CTG	NO	ISOLEUCINE	2		
ATT	NO				
ATC	YES				
ATA	YES	METHIONINE	0		
ATG	NO				
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	NO	TRYPTOPHAN	0		
CCT	NO	PROLINE	2		
CCC	YES				
CCA	YES				
CCG	NO				
TCT	NO	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	YES				
TCA	YES				
TCG	NO				
AGT	NO				
AGC	YES	CYSTEINE	1		
TGT	NO				
TGC	YES	ASPARAGINE	1		
AAT	NO				
AAC	YES	GLUTAMINE	1		
CAA	YES				
CAG	NO	TYROSINE	1		
TAT	NO				
TAC	YES	THREONINE	2		
ACT	NO				
ACC	YES				
ACA	YES				
ACG	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAT	NO				
GAC	YES				
GAA	YES				
GAG	NO	GLUTAMIC ACID	1		
AAA	YES				
AAG	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
CGT	NO				
CGC	YES				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
64	32	18 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 14: 9: 2: 5: 2	

TABLE 5. N, N, A/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	14
GGC	NO				
GGA	YES				
GGG	NO				
GCT	YES	ALANINE	2		
GCC	NO				
GCA	YES				
GCG	NO				
GTT	YES	VALINE	2		
GTC	NO				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	3		
TTG	NO				
CTT	YES				
CTC	NO				
CTA	YES	ISOLEUCINE	2		
CTG	NO				
ATT	YES				
ATC	NO				
ATA	YES	METHIONINE	0		
ATG	NO				
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	NO	TRYPTOPHAN	0		
CCT	YES				
CCC	NO	PROLINE	2		
CCA	YES				
CCG	NO				
TCT	YES	SERINE	3	POLAR NONIONIZABLE (POL)	9
TCC	NO				
TCA	YES				
TCG	NO				
AGT	YES	CYSTEINE	1		
AGC	NO				
TGT	YES				
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	YES	GLUTAMINE	1		
CAG	NO				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	2		
ACC	NO				
ACA	YES				
ACG	NO				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	NO				
GAA	YES	GLUTAMIC ACID	1		
GAG	NO				
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	5
AAG	NO				
CGT	YES	ARGININE	3		
CGC	NO				
CGA	YES				
CGG	NO				
AGA	YES	HISTIDINE	1		
AGG	NO				
CAT	YES				
CAC	NO				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
64	32	18 Amino Acids Are Represented		NPL: POL: NEG: POS: STP = 14: 9: 2: 5: 2	

TABLE 6. N, N, C/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	2	NONPOLAR (NPL)	14
GGC	YES				
GGA	NO				
GGG	NO				
GCT	YES	ALANINE	2		
GCC	YES				
GCA	NO				
GCG	NO				
GTT	YES	VALINE	2		
GTC	YES				
GTA	NO				
GTG	NO				
TTA	NO	LEUCINE	2		
TTG	NO				
CTT	YES				
CTC	YES				
CTA	NO	ISOLEUCINE	2		
CTG	NO				
ATT	YES				
ATC	YES				
ATA	NO	METHIONINE	0		
ATG	NO				
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	NO	TRYPTOPHAN	0		
CCT	YES				
CCC	YES	PROLINE	2		
CCA	NO				
CCG	NO				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	12
TCC	YES				
TCA	NO				
TCG	NO				
AGT	YES	CYSTEINE	2		
AGC	YES				
TGT	YES				
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	NO	GLUTAMINE	0		
CAG	NO				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	2		
ACC	YES				
ACA	NO				
ACG	NO				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	2
GAC	YES				
GAA	NO	GLUTAMIC ACID	0		
GAG	NO				
AAA	NO	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	NO				
CGT	YES	ARGININE	2		
CGC	YES				
CGA	NO				
CGG	NO				
AGA	NO				
AGG	NO				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0
TAG	NO				
TGA	NO				
64	32	15 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 14: 12: 2: 4: 0	

TABLE 7. N, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	29
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	6	POLAR NONIONIZABLE (POL)	18
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
GAG	YES				
AAA	YES	LYSINE	2		
AAG	YES				
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	64	64	20 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 29: 18: 4: 10: 3	

TABLE 8. N, N, G

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	NO		GLYCINE	1	NONPOLAR (NPL)	8		
GGC	NO							
GGA	NO							
GGG	YES							
GCT	NO		ALANINE	1				
GCC	NO							
GCA	NO							
GCG	YES							
GTT	NO		VALINE	1				
GTC	NO							
GTA	NO							
GTG	YES							
TTA	NO		LEUCINE	2				
TTG	YES							
CTT	NO							
CTC	NO							
CTA	NO							
CTG	YES							
ATT	NO		ISOLEUCINE	0				
ATC	NO							
ATA	NO							
ATG	YES		METHIONINE	1				
TTT	NO		PHENYLALANINE	0				
TTC	NO							
TGG	YES		TRYPTOPHAN	1				
CCT	NO		PROLINE	1				
CCC	NO							
CCA	NO							
CCG	YES							
TCT	NO		SERINE	1	POLAR NONIONIZABLE (POL)	3		
TCC	NO							
TCA	NO							
TCG	YES							
AGT	NO							
AGC	NO							
TGT	NO		CYSTEINE	0				
TGC	NO							
AAT	NO		ASPARAGINE	0				
AAC	NO							
CAA	NO		GLUTAMINE	1				
CAG	YES							
TAT	NO		TYROSINE	0				
TAC	NO							
ACT	NO		THREONINE	1				
ACC	NO							
ACA	NO							
ACG	YES							
GAT	NO		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1		
GAC	NO		GLUTAMIC ACID	1				
GAA	NO							
GAG	YES							
AAA	NO		LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3		
AAG	YES							
CGT	NO		ARGININE	2				
CGC	NO							
CGA	NO							
CGG	YES							
AGA	NO							
AGG	YES							
CAT	NO		HISTIDINE	0				
CAC	NO							
TAA	NO		STOP CODON	1	STOP SIGNAL (STP)	1		
TAG	YES							
TGA	NO							
64	16	13 Amino Acids Are Represented			NPL:POL:NEG:POS:STP = 8: 3: 1: 3: 1			

TABLE 9. N, N, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	NO	GLYCINE	1	NONPOLAR (NPL)	7		
GGC	NO						
GGA	YES						
GGG	NO						
GCT	NO	ALANINE	1				
GCC	NO						
GCA	YES						
GCG	NO						
GTT	NO	VALINE	1				
GTC	NO						
GTA	YES						
GTG	NO						
TTA	YES	LEUCINE	2				
TTG	NO						
CTT	NO						
CTC	NO						
CTA	YES						
CTG	NO	ISOLEUCINE	1				
ATT	NO						
ATC	NO						
ATA	YES						
ATG	NO	METHIONINE	0				
TTT	NO	PHENYLALANINE	0				
TTC	NO	TRYPTOPHAN	0				
TGG	NO						
CCT	NO	PROLINE	1				
CCC	NO						
CCA	YES						
CCG	NO						
TCT	NO	SERINE	1	POLAR NONIONIZABLE (POL)	3		
TCC	NO						
TCA	YES						
TCG	NO						
AGT	NO						
AGC	NO	CYSTEINE	0				
TGT	NO						
TGC	NO	ASPARAGINE	0				
AAT	NO						
AAC	NO	GLUTAMINE	1				
CAA	YES						
CAG	NO	TYROSINE	0				
TAT	NO						
TAC	NO	THREONINE	1				
ACT	NO						
ACC	NO						
ACA	YES						
ACG	NO	ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1		
GAT	NO						
GAC	NO	GLUTAMIC ACID	1				
GAA	YES						
GAG	NO						
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3		
AAG	NO	ARGININE	2				
CGT	NO						
CGC	NO						
CGA	YES						
CGG	NO						
AGA	YES						
AGG	NO	HISTIDINE	0				
CAT	NO						
CAC	NO						
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2		
TAG	NO						
TGA	YES						
64	16	12 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 7: 3: 1: 3: 2			

TABLE 10. N, N, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	1	NONPOLAR (NPL)	7
GGC	YES				
GGA	NO				
GGG	NO				
GCT	NO	ALANINE	1		
GCC	YES				
GCA	NO				
GCG	NO				
GTT	NO	VALINE	1		
GTC	YES				
GTA	NO				
GTG	NO				
TTA	NO	LEUCINE	1		
TTG	NO				
CTT	NO				
CTC	YES				
CTA	NO				
CTG	NO				
ATT	NO	ISOLEUCINE	1		
ATC	YES				
ATA	NO				
ATG	NO	METHIONINE	0		
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	NO	TRYPTOPHAN	0		
CCT	NO	PROLINE	1		
CCC	YES				
CCA	NO				
CCG	NO				
TCT	NO	SERINE	2	POLAR NONIONIZABLE (POL)	6
TCC	YES				
TCA	NO				
TCG	NO				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	NO	GLUTAMINE	0		
CAG	NO				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	1		
ACC	YES				
ACA	NO				
ACG	NO				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	YES				
GAA	NO	GLUTAMIC ACID	0		
GAG	NO				
AAA	NO	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AAG	NO				
CGT	NO	ARGININE	1		
CGC	YES				
CGA	NO				
CGG	NO				
AGA	NO				
AGG	NO				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0
TAG	NO				
TGA	NO				
64	16	15 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 7: 6: 1: 2: 0	

TABLE 11. N, N, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	1	NONPOLAR (NPL)	7
GGC	NO				
GGA	NO				
GGG	NO				
GCT	YES	ALANINE	1		
GCC	NO				
GCA	NO				
GCG	NO				
GTT	YES	VALINE	1		
GTC	NO				
GTA	NO				
GTG	NO				
TTA	NO	LEUCINE	1		
TTG	NO				
CTT	YES				
CTC	NO				
CTA	NO				
CTG	NO				
ATT	YES	ISOLEUCINE	1		
ATC	NO				
ATA	NO				
ATG	NO	METHIONINE	0		
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	NO	TRYPTOPHAN	0		
CCT	YES	PROLINE	1		
CCC	NO				
CCA	NO				
CCG	NO				
TCT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	6
TCC	NO				
TCA	NO				
TCG	NO				
AGT	YES				
AGC	NO				
TGT	YES	CYSTEINE	1		
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	NO	GLUTAMINE	0		
CAG	NO				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	1		
ACC	NO				
ACA	NO				
ACG	NO				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	NO				
GAA	NO	GLUTAMIC ACID	0		
GAG	NO			IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AAA	NO	LYSINE	0		
AAG	NO				
CGT	YES	ARGININE	1		
CGC	NO				
CGA	NO				
CGG	NO				
AGA	NO				
AGG	NO				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	NO	STOP CODON	0	STOP SIGNAL (STP)	0
TAG	NO				
TGA	NO				
64	16	15 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 7: 6: 1: 2: 0	

TABLE 12. N, N, C/G/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	22
GGC	YES				
GGA	NO				
GGG	YES	ALANINE	3		
GCT	YES				
GCC	YES				
GCA	NO	VALINE	3		
GCG	YES				
GTT	YES				
GTC	YES	LEUCINE	4		
GTA	NO				
GTG	YES				
TTA	NO	ISOLEUCINE	2		
TTG	YES				
CTT	YES				
CTC	YES	METHIONINE	1		
CTA	NO				
CTG	YES				
ATT	YES	PHENYLALANINE	2		
ATC	YES				
ATA	NO				
ATG	YES	TRYPTOPHAN	1		
TTT	YES				
TTC	YES				
TGG	YES	PROLINE	3		
CCT	YES				
CCC	YES				
CCA	NO	SERINE	5	POLAR NONIONIZABLE (POL)	15
CCG	YES				
TCT	YES				
TCC	YES	CYSTEINE	2		
TCA	NO				
TCG	YES				
AGT	YES	ASPARAGINE	2		
AGC	YES				
TGT	YES				
TGC	YES	GLUTAMINE	1		
AAT	YES				
AAC	YES				
CAA	NO	TYROSINE	2		
CAG	YES				
TAT	YES				
TAC	YES	THREONINE	3		
ACT	YES				
ACC	YES				
ACA	NO	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
ACG	YES				
GAT	YES				
GAC	YES	GLUTAMIC ACID	1		
GAA	NO				
GAG	YES				
AAA	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	7
AAG	YES				
CGT	YES				
CGC	YES	ARGININE	4		
CGA	NO				
CGG	YES				
AGA	NO	HISTIDINE	2		
AGG	YES				
CAT	YES				
CAC	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TAA	NO				
TAG	YES				
TGA	NO				
64	48	20 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 22: 15: 3: 7: 1	

TABLE 13. N, N, A/G/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	22
GGC	NO				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	3		
GCC	NO				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	3		
GTC	NO				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	5		
TTG	YES				
CTT	YES				
CTC	NO				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	2		
ATC	NO				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	1		
TTC	NO				
TGG	YES	TRYPTOPHAN	1		
CCT	YES	PROLINE	3	POLAR NONIONIZABLE (POL)	12
CCC	NO				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4		
TCC	NO				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	NO				
TGT	YES	CYSTEINE	1		
TGC	NO				
AAT	YES	ASPARAGINE	1		
AAC	NO				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	1		
TAC	NO				
ACT	YES	THREONINE	3		
ACC	NO				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAC	NO				
GAA	YES	GLUTAMIC ACID	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	8
GAG	YES				
AAA	YES	LYSINE	2		
AAG	YES				
CGT	YES	ARGININE	5		
CGC	NO				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	1		
CAC	NO				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
TOTAL	64	48	20 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 22: 12: 3: 8: 3	

TABLE 14. N, N, A/C/T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	3	NONPOLAR (NPL)	21
GGC	YES				
GGA	YES				
GGG	NO				
GCT	YES	ALANINE	3		
GCC	YES				
GCA	YES				
GCG	NO				
GTT	YES	VALINE	3		
GTC	YES				
GTA	YES				
GTG	NO				
TTA	YES	LEUCINE	4		
TTG	NO				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	NO	ISOLEUCINE	3		
ATT	YES				
ATC	YES				
ATA	YES	METHIONINE	0		
ATG	NO				
TTT	YES	PHENYLALANINE	2		
TTC	YES	TRYPTOPHAN	0		
TGG	NO				
CCT	YES				
CCC	YES				
CCA	YES	PROLINE	3		
CCG	NO				
TCT	YES	SERINE	5	POLAR NONIONIZABLE (POL)	15
TCC	YES				
TCA	YES				
TCG	NO				
AGT	YES	CYSTEINE	2		
AGC	YES				
TGT	YES				
TGC	YES	ASPARAGINE	2		
AAT	YES				
AAC	YES	GLUTAMINE	1		
CAA	YES				
CAG	NO	TYROSINE	2		
TAT	YES				
TAC	YES	THREONINE	3		
ACT	YES				
ACC	YES				
ACA	YES				
ACG	NO	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAT	YES				
GAC	YES	GLUTAMIC ACID	1		
GAA	YES				
GAG	NO	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	7
AAA	YES				
AAG	NO	ARGININE	4		
CGT	YES				
CGC	YES				
CGA	YES				
CGG	NO				
AGA	YES				
AGG	NO	HISTIDINE	2		
CAT	YES				
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	NO				
TGA	YES				
64	48	18 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 21: 15: 3: 7: 2	

TABLE 15. N, N, A/C/G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	NO	GLYCINE	3	NONPOLAR (NPL)	22
GGC	YES				
GGA	YES				
GGG	YES				
GCT	NO	ALANINE	3		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	NO	VALINE	3		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	5		
TTG	YES				
CTT	NO				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	NO	ISOLEUCINE	2		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	NO	PHENYLALANINE	1		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
CCT	NO	PROLINE	3		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	NO	SERINE	4	POLAR NONIONIZABLE (POL)	12
TCC	YES				
TCA	YES				
TCG	YES				
AGT	NO				
AGC	YES				
TGT	NO	CYSTEINE	1		
TGC	YES				
AAT	NO	ASPARAGINE	1		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	NO	TYROSINE	1		
TAC	YES				
ACT	NO	THREONINE	3		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	NO	ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	3
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	8
AAG	YES				
CGT	NO	ARGININE	5		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	NO	HISTIDINE	1		
CAC	YES				
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
64	48	20 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 22: 12: 3: 8: 3	

TABLE 16. N, A, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	ASPARTIC ACID	0		
		GLUTAMIC ACID	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
AAA	YES	LYSINE	1		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	1
TAA	YES	STOP CODON	1		
4			3 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 1: 1: 1: 1	

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TABLE 17. N, A, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
AAC	YES	ASPARAGINE	1		
		GLUTAMINE	0		
TAC	YES	TYROSINE	1		
		THREONINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAC	YES	ASPARTIC ACID	1		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		LYSINE	0		
		ARGININE	0		
CAC	YES	HISTIDINE	1	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 2: 1: 1: 0	

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TABLE 18. N, A, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAG	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAG	YES	GLUTAMIC ACID	1		
		LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
AAG	YES	ARGININE	0		
		HISTIDINE	0		
TAG	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		4	3 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 1: 1: 1: 1	

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TABLE 19. N, A, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
AAT	YES	ASPARAGINE	1		
		GLUTAMINE	0		
TAT	YES	TYROSINE	1		
		THREONINE	0		
		ASPARTIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAT	YES	GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
CAT	YES	HISTIDINE	1		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 0: 2: 1: 1: 0	

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TABLE 20. N, C, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACA	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

5

TABLE 21. N, C, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCC	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCC	YES	PROLINE	1		
TCC	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACC	YES	THREONINE	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

10

TABLE 22. N, C, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCG	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCG	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCG	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACG	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 23. N, C, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCT	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCT	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACT	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 2: 0: 0: 0	

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TABLE 24. N, G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
CGA	YES	LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AGA	YES	ARGININE	2		
		HISTIDINE	0		
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		4	2 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 1: 0: 0: 2: 1	

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TABLE 25. N, G, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGC	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
AGC	YES	SERINE	1	POLAR NONIONIZABLE (POL)	2
TGC	YES	CYSTEINE	1		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
CGC	YES	ARGININE	1		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 1: 2: 0: 1: 0	

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TABLE 26. N, G, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGG	YES	GLYCINE	1	NONPOLAR (NPL)	2
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0	POLAR NONIONIZABLE (POL)	0
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
CGG	YES	ARGININE	2		
AGG	YES	HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
4				3 Amino Acids Are Represented	
				NPL:POL:NEG:POS:STP = 2: 0: 0: 2: 0	

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TABLE 27. N, G, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0	POLAR NONIONIZABLE (POL)	2
AGT	YES	SERINE	1		
TGT	YES	CYSTEINE	1		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
CGT	YES	ARGININE	1		
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
4				4 Amino Acids Are Represented	
				NPL:POL:NEG:POS:STP = 1: 2: 0: 1: 0	

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TABLE 28. N, T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0	POLAR NONIONIZABLE (POL)	0
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	3 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

5

TABLE 29. N, T, C

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTC	YES	VALINE	1		
CTC	YES	LEUCINE	1		
ATC	YES	ISOLEUCINE	1		
		METHIONINE	0		
TTC	YES	PHENYLALANINE	1		
		TRYPTOPHAN	0		
		PROLINE	0	POLAR NONIONIZABLE (POL)	0
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 30. N, T, G

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTG	YES	VALINE	1		
TTG	YES	LEUCINE	2		
CTG	YES				
		ISOLEUCINE	0		
ATG	YES	METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	3 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 31. N, T, T

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTT	YES	VALINE	1		
CTT	YES	LEUCINE	1		
ATT	YES	ISOLEUCINE	1		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	1		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL		4	4 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 0: 0: 0: 0	

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TABLE 32. N, A/C, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	2
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1	POLAR NONIONIZABLE (POL)	3
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		8	7 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 2: 3: 1: 1: 1	

5

TABLE 33. N, A/G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	1
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TGA	YES				
TOTAL		8	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 1: 1: 1: 3: 2	

TABLE 34. N, A/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	1
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		8	6 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 1: 1: 1: 1	

5

TABLE 35. N, C/G, A

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES		GLYCINE	1	NONPOLAR (NPL)	3
GCA	YES		ALANINE	1		
			VALINE	0		
			LEUCINE	0		
			ISOLEUCINE	0		
			METHIONINE	0		
			PHENYLALANINE	0		
			TRYPTOPHAN	0		
CCA	YES		PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCA	YES		SERINE	1		
			CYSTEINE	0		
			ASPARAGINE	0		
			GLUTAMINE	0		
			TYROSINE	0		
ACA	YES		THREONINE	1		
			ASPARTIC ACID	0		
			GLUTAMIC ACID	0		
			LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
CGA	YES		ARGININE	2		
AGA	YES					
			HISTIDINE	0	STOP SIGNAL (STP)	1
TGA	YES		STOP CODON	1		
8				6 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 3: 2: 0: 2: 1

TABLE 36. N, C/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	6
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	2
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		LYSINE	0		
		ARGININE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
8				7 Amino Acids Are Represented	
				NPL:POL:NEG:POS:STP = 6: 2: 0: 0: 0	

5

TABLE 37. N, T/G, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	5
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	0
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		LYSINE	0		
CGA	YES	ARGININE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
AGA	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	1
TGA	YES	STOP CODON	1		
8				5 Amino Acids Are Represented	
				NPL:POL:NEG:POS:STP = 5: 0: 0: 2: 1	

TABLE 38. N, C/G/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	7
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0	POLAR NONIONIZABLE (POL)	2
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1		
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	2
CGA	YES	ARGININE	2		
AGA	YES			STOP SIGNAL (STP)	1
		HISTIDINE	0		
TGA	YES	STOP CODON	1		
TOTAL		12	9 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 7: 2: 0: 2: 1	

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TABLE 39. N, A/G/T, A

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	5
		ALANINE	0		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0	POLAR NONIONIZABLE (POL)	1
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
CAA	YES	GLUTAMINE	1		
		TYROSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	STOP SIGNAL (STP)	2
CGA	YES	ARGININE	2		
AGA	YES			STOP SIGNAL (STP)	2
		HISTIDINE	0		
TAA	YES	STOP CODON	2		
TGA	YES				
TOTAL		12	8 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 1: 1: 3: 2	

TABLE 40. N, A/C/T, A

TABLE 40. N, A/C/I, A					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	6
GCA	YES	ALANINE	1		
GTA	YES	VALINE	1		
TTA	YES	LEUCINE	2		
CTA	YES				
ATA	YES	ISOLEUCINE	1		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	3
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0		
GAA	YES	GLUTAMIC ACID	1		
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	1
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		12	10 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 6: 3: 1: 1: 1	

5 TABLE 41. N, A/C/G, A

TABLE 4.1. N, A/C/G, A					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGA	YES	GLYCINE	1	NONPOLAR (NPL)	3
GCA	YES	ALANINE	1		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCA	YES	PROLINE	1	POLAR NONIONIZABLE (POL)	3
TCA	YES	SERINE	1		
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	1		
		TYROSINE	0		
ACA	YES	THREONINE	1		
		ASPARTIC ACID	0		
GAA	YES	GLUTAMIC ACID	1	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	1
AAA	YES	LYSINE	1	IONIZABLE: BASIC POSITIVE CHARGE (POS)	3
CGA	YES	ARGININE	2		
AGA	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TGA	YES				
TOTAL	12	9 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 3: 3: 1: 3: 2	

TABLE 42. A, N, N

TABLE 42. A, N, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	4
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES				
		METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	8
AGC	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
AGA	YES	ARGININE	2		
AGG	YES				
		HISTIDINE	0	STOP SIGNAL (STP)	0
		STOP CODON	0		
TOTAL		16	7 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 4: 8: 0: 4: 0	

5 TABLE 43. C, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	8
		ALANINE	0		
		VALINE	0		
CIT	YES	LEUCINE	4		
CIC	YES				
CTA	YES				
CTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4	POLAR NONIONIZABLE (POL)	2
CCC	YES				
CCA	YES				
CCG	YES				
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
CAA	YES	GLUTAMINE	2		
CAG	YES				
		TYROSINE	0		
		THREONINE	0		
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES	ARGININE	4		
CGC	YES				
CGA	YES				
CGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
		STOP CODON	0		
				STOP SIGNAL (STP)	0
TOTAL		16	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 8: 2: 0: 6: 0	

TABLE 44. G, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	12
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2		
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
		LYSINE	0		
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0		
				STOP SIGNAL (STP)	0
TOTAL		16	5 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 12: 0: 4: 0: 0	

5

TABLE 45. T, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	5
		ALANINE	0		
		VALINE	0		
TTA	YES	LEUCINE	2		
TTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0	POLAR NONIONIZABLE (POL)	8
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
TCT	YES	SERINE	4		
TCC	YES				
TCA	YES				
TCG	YES				
TGT	YES	CYSTEINE	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
TAT	YES	TYROSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
TAC	YES				
		THREONINE	0		
		ASPARTIC ACID	0	STOP SIGNAL (STP)	3
		GLUTAMIC ACID	0		
		LYSINE	0		
		ARGININE	0	STOP CODON	3
		HISTIDINE	0		
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES			STOP SIGNAL (STP)	3
TOTAL		16	6 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 5: 8: 0: 0: 3	

TABLE 46. A/C, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	12
		ALANINE	0		
		VALINE	0		
CTT	YES	LEUCINE	4		
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES				
		METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	10
AGC	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
		ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMIC ACID	0		
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10
AAG	YES				
CGT	YES	ARGININE	6		
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES				
CAT	YES	HISTIDINE	2		
CAC	YES				
		STOP CODON	0	STOP SIGNAL (STP)	0
32		11 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 12: 10: 0: 10: 0	

TABLE 47. A/G, N, N

A/G, N, N			CATEGORY		(Frequency)
CODON	Represented	AMINO ACID	(Frequency)		
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	16
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
		LEUCINE	0		
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	8
AGC	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
AGA	YES	ARGININE	2		
AGG	YES				
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
32		12 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 16: 8: 4: 4: 0	

TABLE 48. A/T, N, N

A/T, N, N			CATEGORY (Frequency)	
CODON	Represented	AMINO ACID (Frequency)		
		GLYCINE 0	NONPOLAR (NPL)	9
		ALANINE 0		
		VALINE 0		
TTA	YES	LEUCINE 2		
TTG	YES			
ATT	YES	ISOLEUCINE 3		
ATC	YES			
ATA	YES			
ATG	YES	METHIONINE 1		
TTT	YES	PHENYLALANINE 2		
TTC	YES			
TGG	YES	TRYPTOPHAN 1		
		PROLINE 0		
TCT	YES	SERINE 6	POLAR NONIONIZABLE (POL)	16
TCC	YES			
TCA	YES			
TCG	YES			
AGT	YES			
AGC	YES			
TGT	YES	CYSTEINE 2		
TGC	YES			
AAT	YES	ASPARAGINE 2		
AAC	YES			
		GLUTAMINE 0		
TAT	YES	TYROSINE 2		
TAC	YES			
ACT	YES	THREONINE 4		
ACC	YES			
ACA	YES			
ACG	YES			
		ASPARTIC ACID 0		
		GLUTAMIC ACID 0		
AAA	YES	LYSINE 2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES			
AGA	YES	ARGININE 2		
AGG	YES			
		HISTIDINE 0		
TAA	YES	STOP CODON 3	STOP SIGNAL (STP)	3
TAG	YES			
TGA	YES			
32		12 Amino Acids Are Represented	NPL:POL:NEG:POS:STP = 9: 16: 0: 4: 3	

TABLE 49. C/G, N, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)	
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	20	
GGC	YES					
GGA	YES					
GGG	YES					
GCT	YES	ALANINE	4			
GCC	YES					
GCA	YES					
GCG	YES					
GTT	YES	VALINE	4			
GTC	YES					
GTA	YES					
GTG	YES					
CTT	YES	LEUCINE	4			
CTC	YES					
CTA	YES					
CTG	YES					
		ISOLEUCINE	0			
		METHIONINE	0			
		PHENYLALANINE	0			
		TRYPTOPHAN	0			
CCT	YES	PROLINE	4			
CCC	YES					
CCA	YES					
CCG	YES					
		SERINE	0	POLAR NONIONIZABLE (POL)	2	
		CYSTEINE	0			
		ASPARAGINE	0			
CAA	YES	GLUTAMINE	2			
CAG	YES					
		TYROSINE	0			
		THREONINE	0			
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4	
GAC	YES					
GAA	YES	GLUTAMIC ACID	2			
GAG	YES					
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6	
CGT	YES	ARGININE	4			
CGC	YES					
CGA	YES					
CGG	YES					
CAT	YES	HISTIDINE	2			
CAC	YES					
		STOP CODON	0	STOP SIGNAL (STP)	0	
32		10 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 20: 2: 4: 6: 0		

TABLE 50. C/T, N, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
			GLYCINE	0	NONPOLAR (NPL)	13		
			ALANINE	0				
			VALINE	0				
TTA	YES		LEUCINE	6				
TTG	YES							
CTT	YES							
CTC	YES							
CTA	YES							
CTG	YES							
			ISOLEUCINE	0				
			METHIONINE	0				
TTT	YES		PHENYLALANINE	2				
TTC	YES							
TGG	YES		TRYPTOPHAN	1				
CCT	YES		PROLINE	4				
CCC	YES							
CCA	YES							
CCG	YES							
TCT	YES		SERINE	4	POLAR NONIONIZABLE (POL)	10		
TCC	YES							
TCA	YES							
TCG	YES							
TGT	YES		CYSTEINE	2				
TGC	YES							
			ASPARAGINE	0				
CAA	YES		GLUTAMINE	2				
CAG	YES							
TAT	YES		TYROSINE	2				
TAC	YES							
			THREONINE	0				
			ASPARTIC ACID	0			IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
			GLUTAMIC ACID	0				
			LYSINE	0			IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
CGT	YES		ARGININE	4				
CGC	YES							
CGA	YES							
CGG	YES							
CAT	YES		HISTIDINE	2				
CAC	YES							
TAA	YES	STOP CODON		3	STOP SIGNAL (STP)	3		
TAG	YES							
TGA	YES							
TOTAL		32	10 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 13: 10: 0: 6: 3			

TABLE 51. G/T, N, N

G/T, N, N			CATEGORY		
CODON	Represented	AMINO ACID	(Frequency)	(Frequency)	
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	17
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	2		
TTG	YES				
		ISOLEUCINE	0		
		METHIONINE	0		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
TGG	YES	TRYPTOPHAN	1		
		PROLINE	0		
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0		
		GLUTAMINE	0		
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
TAA	YES	STOP CODON	3	STOP SIGNAL (STP)	3
TAG	YES				
TGA	YES				
32		11 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 17: 8: 4: 0: 3	

TABLE 52. N, A, N

TABLE 52. N, A, N					
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	0
		ALANINE	0		
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
		TRYPTOPHAN	0		
		PROLINE	0		
		SERINE	0	POLAR NONIONIZABLE (POL)	6
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES				
		ARGININE	0		
CAT	YES	HISTIDINE	2		
CAC	YES				
TAA	YES	STOP CODON	2	STOP SIGNAL (STP)	2
TAG	YES				
TOTAL	16	7 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 0: 6: 4: 4: 2	

5 TABLE 53. N, C, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	8
GCT	YES		ALANINE	4		
GCC	YES					
GCA	YES					
GCG	YES					
			VALINE	0		
			LEUCINE	0		
			ISOLEUCINE	0		
			METHIONINE	0		
			PHENYLALANINE	0		
			TRYPTOPHAN	0		
CCT	YES		PROLINE	4	POLAR NONIONIZABLE (POL)	8
CCC	YES					
CCA	YES					
CCG	YES					
TCT	YES		SERINE	4		
TCC	YES					
TCA	YES					
TCG	YES					
			CYSTEINE	0		
			ASPARAGINE	0		
			GLUTAMINE	0		
			TYROSINE	0		
ACT	YES		THREONINE	4	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACC	YES					
ACA	YES					
ACG	YES					
			ASPARTIC ACID	0		
			GLUTAMIC ACID	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
			LYSINE	0		
			ARGININE	0		
			HISTIDINE	0		
			STOP CODON	0		
					STOP SIGNAL (STP)	0
TOTAL		16	4 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 8: 8: 0: 0: 0	

TABLE 54. N, G, N

N, G, N						
CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)	
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	5	
GGC	YES					
GGA	YES					
GGG	YES					
		ALANINE	0			
		VALINE	0			
		LEUCINE	0			
		ISOLEUCINE	0			
		METHIONINE	0			
		PHENYLALANINE	0			
TGG	YES	TRYPTOPHAN	1			
		PROLINE	0			
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	4	
AGC	YES					
TGT	YES	CYSTEINE	2			
TGC	YES					
		ASPARAGINE	0			
		GLUTAMINE	0			
		TYROSINE	0			
		THREONINE	0			
		ASPARTIC ACID	0			
		GLUTAMIC ACID	0			
		LYSINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0	
CGT	YES	ARGININE	6	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6	
CGC	YES					
CGA	YES					
CGG	YES					
AGA	YES					
AGG	YES					
		HISTIDINE	0			
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1	
16			5 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 5: 4: 0: 6: 1	

TABLE 55. N, T, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	16
			ALANINE	0		
GTT	YES		VALINE	4		
GTC	YES					
GTA	YES					
GTG	YES					
TTA	YES		LEUCINE	6		
TTG	YES					
CTT	YES					
CTC	YES					
CTA	YES					
CTG	YES					
ATT	YES		ISOLEUCINE	3		
ATC	YES					
ATA	YES					
ATG	YES		METHIONINE	1		
TTT	YES		PHENYLALANINE	2		
TTC	YES					
			TRYPTOPHAN	0		
			PROLINE	0		
			SERINE	0	POLAR NONIONIZABLE (POL)	0
			CYSTEINE	0		
			ASPARAGINE	0		
			GLUTAMINE	0		
			TYROSINE	0		
			THREONINE	0		
			ASPARTIC ACID	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
			GLUTAMIC ACID	0		
			LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
			ARGININE	0		
			HISTIDINE	0		
			STOP CODON	0	STOP SIGNAL (STP)	0
		16	5 Amino Acids Are Represented		NPL:POL:NEG:POS:STP = 16: 0: 0: 0: 0	

TABLE 56. N, A/C, N

CODON		Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
			GLYCINE	0	NONPOLAR (NPL)	8
GCT	YES		ALANINE	4		
GCC	YES					
GCA	YES					
GCG	YES					
			VALINE	0		
			LEUCINE	0		
			ISOLEUCINE	0		
			METHIONINE	0		
			PHENYLALANINE	0		
			TRYPTOPHAN	0		
CCT	YES		PROLINE	4		
CCC	YES					
CCA	YES					
CCG	YES					
TCT	YES		SERINE	4	POLAR NONIONIZABLE (POL)	14
TCC	YES					
TCA	YES					
TCG	YES					
			CYSTEINE	0		
AAT	YES		ASPARAGINE	2		
AAC	YES					
CAA	YES		GLUTAMINE	2		
CAG	YES					
TAT	YES		TYROSINE	2		
TAC	YES					
ACT	YES		THREONINE	4		
ACC	YES					
ACA	YES					
ACG	YES					
GAT	YES		ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES					
GAA	YES		GLUTAMIC ACID	2		
GAG	YES					
AAA	YES		LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
AAG	YES					
			ARGININE	0		
CAT	YES		HISTIDINE	2		
CAC	YES					
TAA	YES		STOP CODON	2	STOP SIGNAL (STP)	2
TAG	YES					
32		11 Amino Acids Are Represented			NPL: POL: NEG: POS: STP 8: 14: 4: 4: 2	

TABLE 57. N, A/G, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)		
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	5		
GGC	YES						
GGA	YES						
GGG	YES						
		ALANINE	0				
		VALINE	0				
		LEUCINE	0				
		ISOLEUCINE	0				
		METHIONINE	0				
		PHENYLALANINE	0				
TGG	YES	TRYPTOPHAN	1				
		PROLINE	0				
AGT	YES	SERINE	2	POLAR NONIONIZABLE (POL)	10		
AGC	YES						
TGT	YES	CYSTEINE	2				
TGC	YES						
AAT	YES	ASPARAGINE	2				
AAC	YES						
CAA	YES	GLUTAMINE	2				
CAG	YES						
TAT	YES	TYROSINE	2				
TAC	YES						
		THREONINE	0				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4		
GAC	YES						
GAA	YES	GLUTAMIC ACID	2				
GAG	YES						
AAA	YES	LYSINE	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	10		
AAG	YES						
CGT	YES	ARGININE	6				
CGC	YES						
CGA	YES						
CGG	YES						
AGA	YES						
AGG	YES						
CAT	YES	HISTIDINE	2			STOP SIGNAL (STP)	3
CAC	YES						
TAA	YES	STOP CODON	3				
TAG	YES						
TGA	YES						
32		12 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 5: 10: 4: 10: 3			

TABLE 58. N, A/T, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	16
		ALANINE	0		
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
		TRYPTOPHAN	0	POLAR NONIONIZABLE (POL)	6
		PROLINE	0		
		SERINE	0		
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
TAC	YES				
		THREONINE	0		
GAT	YES	ASPARTIC ACID	2		
GAC	YES			IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
GAA	YES	GLUTAMIC ACID	2		
GAG	YES				
AAA	YES	LYSINE	2		
AAG	YES			STOP SIGNAL (STP)	2
		ARGININE	0		
CAT	YES	HISTIDINE	2		
CAC	YES			STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TAG	YES				
TOTAL	32	12 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 16: 6: 4: 4: 2	

TABLE 59. N, C/G, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
GGT	YES	GLYCINE	4	NONPOLAR (NPL)	13
GGC	YES				
GGA	YES				
GGG	YES				
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
		VALINE	0		
		LEUCINE	0		
		ISOLEUCINE	0		
		METHIONINE	0		
		PHENYLALANINE	0		
TGG	YES	TRYPTOPHAN	1	POLAR NONIONIZABLE (POL)	12
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	6		
TCC	YES				
TCA	YES				
TCG	YES				
AGT	YES				
AGC	YES				
TGT	YES	CYSTEINE	2		
TGC	YES				
		ASPARAGINE	0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6
ACC	YES				
ACA	YES				
ACG	YES				
		LYSINE	0		
		ARGININE	6		
CGT	YES				
CGC	YES				
CGA	YES				
CGG	YES				
AGA	YES				
AGG	YES			HISTIDINE	0
TGA	YES	STOP CODON	1	STOP SIGNAL (STP)	1
TOTAL		32	8 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 13: 12: 0: 6: 1	

TABLE 60. N, C/T, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	24
GCT	YES	ALANINE	4		
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GTG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
		TRYPTOPHAN	0		
CCT	YES	PROLINE	4		
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4	POLAR NONIONIZABLE (POL)	8
TCC	YES				
TCA	YES				
TCG	YES				
		CYSTEINE	0		
		ASPARAGINE	0		
		GLUTAMINE	0		
		TYROSINE	0		
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES			IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0
ACG	YES				
		ASPARTIC ACID	0		
		GLUTAMIC ACID	0		
		LYSINE	0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	0
		ARGININE	0		
		HISTIDINE	0		
		STOP CODON	0	STOP SIGNAL (STP)	0
TOTAL	32	9 Amino Acids Are Represented		NPL: POL: NEG: POS: STP 24: 8: 0: 0: 0	

TABLE 61. N, G/T, N

N, G/T, N			CATEGORY (Frequency)			
CODON	Represented	AMINO ACID (Frequency)				
GGT	YES	GLYCINE 4	NONPOLAR (NPL)	21		
GGC	YES					
GGA	YES					
GGG	YES					
		ALANINE 0				
GTT	YES	VALINE 4				
GTC	YES					
GTA	YES					
GTG	YES					
TTA	YES	LEUCINE 6				
TTG	YES					
CTT	YES					
CTC	YES					
CTA	YES					
CTG	YES					
ATT	YES	ISOLEUCINE 3				
ATC	YES					
ATA	YES					
ATG	YES	METHIONINE 1				
TTT	YES	PHENYLALANINE 2				
TTC	YES					
TGG	YES	TRYPTOPHAN 1				
		PROLINE 0				
AGT	YES	SERINE 2	POLAR NONIONIZABLE (POL)	4		
AGC	YES					
TGT	YES	CYSTEINE 2				
TGC	YES					
		ASPARAGINE 0				
		GLUTAMINE 0				
		TYROSINE 0				
		THREONINE 0				
		ASPARTIC ACID 0	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	0		
		GLUTAMIC ACID 0				
		LYSINE 0	IONIZABLE: BASIC POSITIVE CHARGE (POS)	6		
CGT	YES	ARGININE 6				
CGC	YES					
CGA	YES					
CGG	YES					
AGA	YES					
AGG	YES					
		HISTIDINE 0				
TGA	YES	STOP CODON 1	STOP SIGNAL (STP)	1		
32			10 Amino Acids Are Represented			
			NPL: POL: NEG: POS: STP 21: 4: 0: 6: 1			

TABLE 62. N, A/C/G, N

N, A/C/G, N				
CODON	Represented	AMINO ACID (Frequency)	CATEGORY (Frequency)	
GGT	YES	GLYCINE 4	NONPOLAR (NPL) 13	
GGC	YES			
GGA	YES			
GGG	YES			
GCT	YES	ALANINE 4		
GCC	YES			
GCA	YES			
GCG	YES			
		VALINE 0		
		LEUCINE 0		
		ISOLEUCINE 0		
		METHIONINE 0		
		PHENYLALANINE 0		
TGG	YES	TRYPTOPHAN 1		
CCT	YES	PROLINE 4		
CCC	YES			
CCA	YES			
CCG	YES			
TCT	YES	SERINE 6	POLAR NONIONIZABLE (POL) 18	
TCC	YES			
TCA	YES			
TCG	YES			
AGT	YES	CYSTEINE 2		
AGC	YES			
TGT	YES			
TGC	YES			
AAT	YES	ASPARAGINE 2		
AAC	YES	GLUTAMINE 2		
CAA	YES			
CAG	YES			
TAT	YES	TYROSINE 2		
TAC	YES	THREONINE 4		
ACT	YES			
ACC	YES			
ACA	YES			
ACG	YES			
GAT	YES	ASPARTIC ACID 2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG) 4	
GAC	YES			
GAA	YES	GLUTAMIC ACID 2		
GAG	YES			
AAA	YES	LYSINE 2	IONIZABLE: BASIC POSITIVE CHARGE (POS) 10	
AAG	YES			
CGT	YES	ARGININE 6		
CGC	YES			
CGA	YES			
CGG	YES			
AGA	YES			
AGG	YES			
CAT	YES	HISTIDINE 2		
CAC	YES			
TAA	YES	STOP CODON 3		STOP SIGNAL (STP) 3
TAG	YES			
TGA	YES			
48		15 Amino Acids Are Represented	NPL: POL: NEG: POS: STP 13: 18: 4: 10: 3	

TABLE 63. N, A/C/T, N

CODON	Represented	AMINO ACID	(Frequency)	CATEGORY	(Frequency)
		GLYCINE	0	NONPOLAR (NPL)	24
		ALANINE	4		
GCT	YES				
GCC	YES				
GCA	YES				
GCG	YES				
GTT	YES	VALINE	4		
GTC	YES				
GTA	YES				
GIG	YES				
TTA	YES	LEUCINE	6		
TTG	YES				
CTT	YES				
CTC	YES				
CTA	YES				
CTG	YES				
ATT	YES	ISOLEUCINE	3		
ATC	YES				
ATA	YES				
ATG	YES	METHIONINE	1		
TTT	YES	PHENYLALANINE	2		
TTC	YES				
		TRYPTOPHAN	0	POLAR NONIONIZABLE (POL)	14
		PROLINE	4		
CCT	YES				
CCC	YES				
CCA	YES				
CCG	YES				
TCT	YES	SERINE	4		
TCC	YES				
TCA	YES				
TCG	YES				
		CYSTEINE	0		
AAT	YES	ASPARAGINE	2		
AAC	YES				
CAA	YES	GLUTAMINE	2		
CAG	YES				
TAT	YES	TYROSINE	2		
TAC	YES				
ACT	YES	THREONINE	4		
ACC	YES				
ACA	YES				
ACG	YES				
GAT	YES	ASPARTIC ACID	2	IONIZABLE: ACIDIC NEGATIVE CHARGE (NEG)	4
GAC	YES				
GAA	YES	GLUTAMIC ACID	2	IONIZABLE: BASIC POSITIVE CHARGE (POS)	4
GAG	YES				
AAA	YES	LYSINE	2	STOP SIGNAL (STP)	2
AAG	YES				
		ARGININE	0	STOP SIGNAL (STP)	2
CAT	YES	HISTIDINE	2		
CAC	YES			STOP SIGNAL (STP)	2
TAA	YES	STOP CODON	2		
TAG	YES			STOP SIGNAL (STP)	2

TOTAL

48

16 Amino Acids Are
RepresentedNPL: POL: NEG: POS: STP
24: 14: 4: 4: 2